

specimen, thus accounting for the apparently smaller dimensions of the Port Moresby specimens. It appears that the true *greyi* inhabits the less wooded central area of Australia from north to south, and the disparity in habitat thus shown, coupled with the larger dimensions of the Papuan form, in comparison with the type dimensions of Dobson, and a specimen from north-western Queensland, leaves no doubt of its specific distinction.

The name of Colin C. Sanborn, Assistant Curator of Mammals in the Field Museum of Natural History, is associated with this species in appreciation of his careful work upon the Chiroptera of the south Pacific, and the well remembered hospitality afforded at the Field Museum and his home during a visit to Chicago at the end of 1930.

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ON NEW FORMS OF THE EASTERN SWAMP RAT,  
AND THE RELATIONSHIP OF MASTACOMYS.

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The fact that it has been customary in the past to accord far too extensive a range to many individual forms of Australian mammals is specially emphasised by the study of coastal races of indigenous rats, which are not subject to the drastic and prolonged changes, and extensive migrations, experienced by inhabitants of the central regions.

It was quite understandable that explorer-naturalists in a vast new land should fail to appreciate the definite effect of zoo-geographical barriers, now made apparent by detailed survey and more or less continuous lines of communication. It is surprising, however, to find a present day tendency to minimise the importance of obvious geographical barriers on the mainland, as well as those represented by a considerable expanse of sea such as that of Bass Strait.

During the course of early and remarkably comprehensive work upon the smaller mammals, examination of the superficial features of colour and pelage of odd specimens taken in somewhat similar surroundings, but often over a thousand miles apart, led to the merging of forms which a study of diagnostic criteria found in their skulls and dentition now proves to be specifically distinct, or at least represented by intermediate races.

A notable instance of the above is provided by the group of dusky-footed swamp rats, the south Western Australian form of which (*fuscipes*, 1839) was originally accorded an immense coastal range extending to Tasmania and north coastal New South Wales. The fallacy of this conception was recognised when Oldfield Thomas decided to regard all eastern members of the group as representing *lutreolus* of Gray (1841). He was in error, however, in selecting as lectotype of *lutreolus* a Gouldian specimen from the Hunter River district of mid-coastal New South Wales, as the South Australian habitat of Gray's original specimen is clearly established.

Previously Thomas had described (1882), from Tasmania, a rather poorly defined soft-furred animal of the group as *velutinus*, which he then regarded as occurring coincidentally on the island with "*Mus fuscipes*" of the south-west. It is notable of the Tasmanian animals that no examples have since been recognised and recorded as *velutinus*, while examination by the author in 1930 of British Museum series, including types of *velutinus*,

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\*Contribution from the Australian Museum.

and specimens labelled *lutreolus* of Tasmania, indicated that there was apparently but one extremely variable form of the group occurring in Tasmania, which may appropriately be listed as *R. lutreolus velutinus* in tribute to its obvious mainland affinity.

Regarding colour variation in the group, Finlayson<sup>(1)</sup> expressed the view that the brighter toned animals were from mountainous regions, and the colder toned more blackish ones from about sea level in coastal areas. In Tasmanian lowland series, however, one finds marked variation, from fuscous to ochraceous-toned animals irrespective of sex, while in New South Wales a richly rufous-toned animal occurs in swampy coastal areas. The latter is less variable in colour and appears to represent a stouter built, coarser furred, warmer coloured animal than the typical southern form, as might be expected from the disparity in range, and it is now described as a new geographical race of *lutreolus*.

An interesting extension of the vast coastal range of *lutreolus* is provided by a male and female from Imbil, near Gympie, south-eastern Queensland, which are now described as representing a new geographical race, and supply the first record of the species occurrence in the northern State. The specimens were submitted with other species by the Forestry Department for identification in regard to damage by rats to the Hoop Pine plantations, and forwarded by Mr. W. A. MacDougall, of the Bureau of Sugar Experiment Stations, together with a north Queensland collection submitted in connection with the investigation of rat problems on the canefields.

The habitat of the dusky-footed swamp rats appears to be quite similar, irrespective of altitude, over their remarkably extensive and naturally coastal mainland range. The haunts of the south-western *fuscipes* given by Gould are similar to those recorded by Waite for the Blue Mountains specimens of eastern *lutreolus*, when quoting the donor as saying that a peaty ridge was their favourite burrowing place, from which long surface runways were made to the water which seemed essential and in which they swam freely.

In Tasmania Finlayson found them inhabiting the same complex labyrinth of runways as *Mastacomys fuscus* in matted grass and alpine vegetation, in a high valley where even in summer the grassy surface is always sodden and often awash. It is notable that the habitat of *lutreolus* appears to be definitely more swampy than that of the paler-footed *R. culmorum* of north coastal Queensland, which is further distinguished by its paler but more coarsely grizzled and spinous coat, longer tail, smaller molars, and much larger tympanic bullae.

In the course of considerable work upon the indigenous rats, undertaken with a view to providing a more informative treatment of the group in the forthcoming popular work on Australian mammals, as well as assisting in the study of health and economic problems, it was hoped to have published detailed notes made during examination of the British Museum collection in 1930. As this has not been possible, an individual note on the hitherto unrecognised pseudomyid relationship of broad-toothed rats of the genus *Mastacomys* is given in conclusion, which may prove of interest to fellow workers in mammalogy.

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<sup>(1)</sup>Finlayson.—Trans. Roy. Soc. S. Austr., lix., 1935, p. 225.

*RATTUS LUTREOLUS CAMBRICUS subsp. nov.*

*Diagnosis.*—A more stoutly built, warmly, but coarsely grizzled, harsher and shorter furred form than the typical southern one; pes and tail longer, the skull larger and more heavily built, and with longer palatal foramina and molar rows. *Habitat.*—Coastal region of New South Wales.

*Description.*—Main dorsal pelage shorter and more rigid, less silky to touch than in French Island or Tasmanian specimens, due mainly to the greater coarseness of the long pile. General dorsal tone much warmer tawny brown owing to the longer and richer light tipping, which is ochraceous-tawny (Ridgway) instead of buckthorn-brown, and the lighter more coppery brown instead of mummy to blackish brown tone of the dark tips and longer pile. Tail, pes, and ear relatively longer than in the southern form. Basal fur darker above and below, and the undersurface washed with a richer tone of ochraceous-buff.

Skull more heavily built, with wider more coarsely ridged interorbital region, larger nasals, and longer palatal foramina; the length and width of the nasalia of the smallest adult female equal to that of a large southern male, and the palatal foramina definitely surpassing the alveolar line instead of barely attaining it. Bullae somewhat smaller, with which is correlated a relatively smaller ear. Upper molar row longer, both in crown and alveolar length.

*Dimensions of Holotype.*—Large adult male, in the flesh: Head and body, 197; tail, 133; pes, including claw, 37; ear, 21 mm.

Skull.—Total length, 43.5; basal length, 39.9; basilar length, 37; zygomatic breadth, 22.4; interorbital width, 5.5; braincase breadth, 16.5; nasals,  $16.8 \times 4.9$ ; palate length, 24.2; palatal foramina,  $7.7 \times 1.9$ ; upper molar rows, 7.9 and 8.2; alveolar length, 8.4; width of  $m^1$ , 2.6 mm.

*Specimens and Habitat.*—Holotype male and allotype female, Nos. M.3192-93 respectively, and paratype males, Nos. M.3190-91, in the Australian Museum collection from Booloombayt, in the Myall Lakes district, north of Newcastle, New South Wales, collected and prepared by Mr. H. Barnes, of the Museum staff, in association with Mr. Harry Burrell. Other specimens from the Sydney, Blue Mountains, Port Macquarie, and Guy Fawkes districts of coastal New South Wales.

*Remarks.*—Apart from slight variation in tone, examination of a series of over twenty specimens leaves no doubt that the New South Wales form is readily distinguishable by the characters detailed above. Excepting when supported by a difference in fur texture, coloration in the *lutreolus* group is of little importance, and the distinction of the New South Wales race is indicated by the coarser, as well as brighter pelage, the coloration of which varies less in all specimens than in those from one district in Tasmania, in addition to the cranial features listed.

*RATTUS LUTREOLUS IMBIL subsp. nov.*

*Diagnosis.*—Of similar body and tail proportions, but with a decidedly richer tawny dorsal coloration and shorter and sparser fur than in *cambricus*. The nasalia decidedly narrower anteriorly, and the bullae shorter than in the intermediate geographical race. *Habitat.*—Gympie district of south-eastern Queensland, the holotype from Imbil.

*Description.*—Pelage shorter and sparser than in *cambricus* and the dorsal coloration richer and more coarsely grizzled owing to the greater width of the brighter tawny tipping, contrasted with the blacker dark tipping and long pile. Fur darker basally above and below, the under-

surface washed with cinnamon. Pes somewhat darker above, about fuscous. Tail of similar length, but ear definitely shorter. Pes less robust and the pads not so strongly defined, notably the subsidiary ones of the 1st and 4th interdigital pads.

Skull of similar general appearance, but cranial region relatively broader and more rounded, and the nasals decidedly narrower anteriorly than in *cambricus*. Palatal foramina surpassing the alveolar margins but relatively shorter and narrower, the bullae shorter, and the upper molar row of similar length to, but wider than those in a skull of *cambricus* of the same length and sex from the nearest locality.

*Dimensions of Holotype*.—From alcohol: Head and body, 181; tail, 111; pes, 32.5; ear, 18.5 × 15.5 mm.

Skull.—Total length, 40.7; basal length, 37; basilar length, 33.8; zygomatic breadth, 22.1; interorbital width, 5.3; braincase breadth, 16.6; nasals, 15.5 × 3.9; palate length, 23.2; palatal foramina, 7.7 × 1.8; upper molar row, 7.9; alveolar length, 8.3; width of  $m^1$  2.6 mm.

*Holotype*.—Adult male skin and skull, No. M.6228 in the Australian Museum collection, from Imbil, Gympie district, south-eastern Queensland, received from the Forestry Department of the State through Mr. W. A. MacDougall, of the Bureau of Sugar Experiment Stations of the Queensland Department of Agriculture.

*Remarks*.—The race is the brightest coloured and shortest coated of the species, and is further distinguished by having a definitely shorter ear, correlated with shorter bullae, and decidedly less expanded nasals anteriorly than in *cambricus*, while the palatal foramina are shorter and the molars wider than in the nearest known specimens of the intermediate race, from the Armidale district of New South Wales.

It is distinguished externally from *culmorum* of north coastal Queensland by the much brighter coloration and less spinous coat, shorter tail, and longer and darker feet, and cranially by the relatively longer skull and much smaller bullae, and larger molars. Distinguished from *sordidus* of the Darling Downs by its much richer brown coloration, shorter tail, decidedly shorter palatal foramina, and somewhat longer more slender nasals.

The typical specimens of the new race of *lutreolus* were included with those of *Rattus assimilis* and *Melomys littoralis* for identification concerning damage by rats in hoop-pine plantations, and it is hoped that description of this race will assist in deciding which species are involved in the destruction.

#### RATTUS LUTREOLUS VELUTINUS Thomas.

*Mus velutinus* Thomas, Ann. Mag. Nat. Hist. (5), ix., 1882, p. 415, June 1. Tasmania (A. Simson).

It is notable regarding the Tasmanian form of narrow-toothed swamp rat that no specifically definable specimen of *velutinus* has been recorded since its description in 1882, either by its author or other workers. The species was described from sub-adult and immature specimens, thus lessening the comparative value of the measurements, and the main diagnostic cranial feature stressed by the author. The front edge of the zygomatic plate was described, and figured, by Oldfield Thomas as slanting forward from the top and thus differing from all other Australian rats, in which it either projects above or is strongly concave below.

Examination of a large series of *lutreolus* collected by Mr. Harry Burrell on the north-west coast of Tasmania in 1921, however, show the profile of the zygomatic plate to be extremely variable, ranging from the normal sinuous outline to the immature slanting condition, while one individual has the plate slightly but evenly concave immediately below the top edge, approaching the condition seen in *Pseudomys* and *Mastacomys*. The slanting profile of the plate is not only a feature of immaturity, but is variable in individuals and cannot therefore be regarded as diagnostic of a distinct species, although the upper profile appears to be less boldly rounded than in typical *lutreolus*.

The coloration is extremely variable irrespective of sex in series from one locality, one lowland series varying dorsally from a similar, and even darker, fuscous-brown than French Island animals, to a bright clay colour faintly pencilled with darker brown, and washed with cinnamon-buff below.

In regard to the variability of colour and cranial features it may be noted that the similarity of habitat, irrespective of altitude, in the more restricted insular region renders differentiation of races unlikely, while the general similarity to southern mainland animals appears to indicate that only one species of narrow-toothed swamp rat is at present recognisable from Tasmania, as represented by the above extremely variable race of *Rattus lutreolus*.

#### *The Pseudomyid relationship of Mastacomys.*

Since Thomas described the original broad-toothed form (*fuscus*) as a new genus and species in 1882, and Lydekker in 1885 listed cranial remains from the mainland Wellington Caves, no further references were made to the genus until 1922, when Thomas described a smaller form (*mordicus*) from cranial fragments obtained by Professor Wood Jones in a guano cave at Mt. Gambier, South Australia. Subsequently, Finlayson<sup>2</sup> reviewed a series collected in north-west Tasmania, and Brazenor<sup>3</sup> provided a superficial review of Victorian specimens which are recorded as representing the Tasmanian *fuscus*.

Although Thomas noted and figured the markedly concave zygomatic plate, and stressed the reduction of mammae, it is surprising to find that both he and subsequent authors have compared *Mastacomys* with *Rattus* concerning its characteristics, and have overlooked the very definite pseudomyid affinity indicated by these and other characters.

The oversight has doubtless been due to a natural tendency to stress the importance of the unusual molar width which, though comparatively great, is much emphasised by the extraordinary narrowness of the palate, a feature which appears to be at least as important as that of molar width. As to the molar pattern, it is notable that Thomas stressed the difference from "*Mus*" (*Rattus*), while comparison of his figure with various specimens shows the upper molar pattern of *Mastacomys* to agree with that of *Pseudomys higginsi* in having three cusps only on the middle lamina of  $m^1$  and anterior lamina of  $m^2$ , and also therefore in lacking a definite anterior 3rd or outer cusp to  $m^1$ , and the secondary or outer cusps to the hind lamina

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<sup>2</sup>Finlayson.—*Loc. cit.*, lvii., 1933, pp. 125-29, pls. vi.-vii.

<sup>3</sup>Brazenor.—*Mem. Nat. Mus. Melb.*, No. 8, 1934, pp. 159-161.

of  $m^1$  and  $m^2$  which characterise *Rattus*. The length and width of the molar row of course greatly exceeds that of *Pseudomys*, as well as the Tasmanian form of *lutreolus*, and is 1.8 longer and .4 mm. wider than the largest molar row of the New South Wales race of *lutreolus*.

The conformation of the skull, apart from the uniformly greater size, agrees with that of *Pseudomys*, rather than *Rattus*, in the marked globular anterior expansion of the braincase contrasting with the long parallel-sided interorbital constriction, as well as in the lack of interorbital ridges. The even concavity of the anterior edge of the zygomatic plate, with the consequently strong projection above, is remarkably similar to the structure seen in members of the typical genus of the *Pseudomys* group, as well as in the allied genus *Thetomys*.

The external proportions and plastic features are relatively unimportant in comparison with the above, as is the matter of coloration, but it may be noted that the larger ear, and length and slenderness of the pes, agree more with *Pseudomys* than *Rattus*, as does the duplication of the 1st interdental pad, which is more strongly marked in the former. It is interesting to note that, although the tail of *Mastacomys* is proportionately shorter than in either local forms of those genera, it is distinctly though variably lighter below, thus reproducing to some extent a striking feature of *Pseudomys higginsi*, while providing a definite distinction from *Rattus lutreolus* which has a uniformly blackish brown tail.

The superficial resemblance of various cranial features to those of foreign water voles (*Arvicola*), referred to in Finlayson's review of *M. fuscus*, evidently has no significance regarding the heritage and homologies of *Mastacomys*. On the contrary, comparison of the figures suggests that the skull differs markedly in the more evenly globular cranium, widely separated interorbital margins, heavier rostrum, and extremely narrow palate which emphasises the greater width of the molars, the patterns of which cannot be regarded as generically homologous with the microtine dentition of *Arvicola*. It is notable that the incurved zygomatic plate common to both, is not entirely associated with similarity of habitat, as the feature is characteristic of *Pseudomys*, which favours drier and at times sub-desert surroundings, and that the number of mammae is less than in *Arvicola*.

The above comparative review of the characteristics of *Mastacomys* would appear to leave no reasonable doubt of its relationship with *Pseudomys*, of which it is apparently a specialised and possibly ancestral form. The adoption of an extremely swampy habitat and unusual diet has apparently involved increased masticatory power, which is evidenced in the bringing together and enlarging of the molar rows, the patterns of which have retained the pseudomyid character, in common with the deeply incurved zygomatic plate and paired inguinal mammae.

The swampy habitat in association with *R. lutreolus velutinus* apparently accounts for the superficially *Rattus*-like general appearance of *Mastacomys*, but this community of existence actually serves to confirm the phylogenetic distinction shown in the cranial, dental, and mammary characters, while providing the obvious source of differentiation from the allied genus *Pseudomys*, which occurs in the same areas but inhabits drier scrubland.

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